PRODUCT INVENTORY MANAGEMENT

FIELD OF THE INVENTION

The present invention relates broadly to a method and system for managing product inventory levels. The invention also relates generally to a method and system for counting product including but not limited to products of a relatively short shelf life, for example newspapers and perishable goods such as bread.

BACKGROUND OF THE INVENTION

Bread and newspapers are examples of product which must be sold within a small time window, typically one (1) day, due to their short shelf lives. There are other products that have low sales levels and correspondingly low inventory turnover which makes this type of product, such as printer cartridges and rechargeable batteries, expensive to stock. However, those low turnover products must be adequately stocked to ensure sales opportunities are not missed as a result of no available stock.

The term delivery period is understood to mean the average time between successive deliveries of an item to a point of sale. The ratio of shelf life period to the delivery period relates to the ease or difficulty of making adjustments to stock level to ensure products do not become stale and are therefore wasted since they cannot be sold. If this ratio is less than one (1), then there is no opportunity for subsequent deliveries to compensate for sales that are slower or faster than predicted. Slower sales will result in waste whereas faster sales will result in lost sales opportunities. This problem is not addressed by the known practice of distributing product according to predetermined schedules.

In the publishing industry significant waste is generated in the form of unsold publications that are printed, shipped & displayed. These unsold publications are generally returned to the publisher to be shredded. In addition to the cost of shredding, labour is incurred to process the returned publications. Due to the volatility of publication sales, many sites run out of stock & sales are missed which constitutes another loss of value. This sales volatility at a site is further complicated by the distribution mechanism employed in some regions where publications are distributed to agents who "on-distribute" to sub-agents.

Sales activity is only known for the aggregate of the agent and its sub-agents and the ability to accurately and forecast sales from the agents individually is not possible.

In the retail industry data collection devices are used at the point-of-sale (POS) to obtain product information from a label attached to the product. This label is typically in the form of an RF tag or bar code that is read at the POS by a scanner or bar code reader. However, this can only be effected where the retail outlet has a scanner or the product includes such an identifier and there is a mechanism to recognise the products. There are many products that do not include RF tags or for which tags are not economic. Furthermore, these POS devices do not necessarily accurately account for stock levels as they do not account for loss of product through shoplifting or, in the case of perishables, as a result of spoiling.

SUMMARY OF THE INVENTION

According to one aspect of the present invention there is provided a method of managing product inventory levels, said method comprising the steps of:

monitoring the flow of product from one or more outlets to obtain product flow data for each of said outlets;

capturing the product flow data in real time and at a location remote from the outlets; and

depending on the product flow data for each of said outlets, controlling the delivery of product to said outlets to control their inventory.

Preferably the step of capturing the product flow data involves capturing of the data within a database of a remote server which communicates with each of the outlets. More preferably the remote server functions support the control of the delivery of products to the outlets.

Preferably the step of monitoring the flow of product includes monitoring the removal of product inventory from each of the outlets. More preferably the monitoring of the flow of product is performed without any integration into existing data collection devices, such as a point-of-sale (POS) device. Even more preferably the removal of product inventory is monitored by counting the number of products departing the outlet. One embodiment of this counting of the product is effected by weighing a supply of the product

and monitoring the weight loss which will be proportional to the number of products departing the outlet.

Preferably the step of capturing the product flow data includes relaying the product flow data in real time from the outlets to the remove server. More preferably this real time relaying of the product flow data is effected by transferring this data across a communications network such as the Internet.

Preferably the remote server communicates with distribution means and the step of controlling delivery of product includes the issuance of delivery instructions to the distribution means depending on the product flow data. More preferably the delivery instructions are directed to a warehouse from which the product is sourced and then delivered to the nominated outlet. Alternately the delivery instructions direct the warehouse to deliver product to a regional depot from which top-up deliveries to the outlets can be effected. Even more preferably the delivery instructions are directed to one outlet of a regional cluster of outlets and whereupon product from said one outlet which has surplus product is delivered to a product-depleted outlet of the cluster. In one embodiment a driver is able to query the delivery instructions from the field via a wireless communications link.

Preferably the method also comprises the step of detecting and sending information relevant to the flow of product at one or more of the outlets to the remote server wherein this information is used to adjust the delivery of product including weather information.

Preferably the method further comprises the step of sending operational data from the remote server to one or more of the outlets, said operational data including information which assists in determination of the product flow data. More preferably the operational data includes unitary product weights, and the supply of the product weighed relates to product of a substantially identical type and wherein the number of products departing the outlet are calculated by dividing the weight loss by the unitary product weight. Alternately the unitary product weight is deduced as a common divisor of a sequence of weight losses and the product count subsequently calculated based on this deduced unitary weight.

Preferably the method further comprises the step of analysing historical data to assist in the forecasting of future product flow. More preferably the historical data used to forecast product flow includes but is not limited to the product flow data and/or weather data. Even

more preferably this analysis has a resolution sufficient to forecast product flow patterns within the product shelf life. Still more preferably the analysis can be conducted during a product flow period to forecast product flow with the same product flow period. Generally the outlets are retail stores and the step of monitoring the flow of product involves monitoring the sales of product from each of the stores.

According to another aspect of the invention there is provided a system for managing product inventory levels, said system comprising:

means for monitoring the flow of product from one or more outlets so as to obtain product flow data for each of the outlets;

means for capturing the product flow data in real time, said capturing means remotely communicating with the monitoring means;

means for controlling the delivery of product to said outlets, said control means communicating with the capturing means and being configured to selectively deliver product to one or more of said outlets depending on their respective product flow data.

Preferably the capturing means includes a remote server including a database within which the product flow data is retained, the remove server communicating with each of the outlets. More preferably the remote server communicates with the outlets via a communications network, such as the Internet, so that the product flow data can in real time be transmitted to the remote server.

Preferably the monitoring means includes means for counting product departing each of the outlets. More preferably said counting means is independent of a data collection device, such as a POS device. Even more preferably this counting means includes means for weighing a supply of the product from which the weight loss is measured in order to deduce the number of products removed from the supply and departing the respective outlet.

Preferably the control means includes distribution means in communication with the remote server, the distribution means being configured to provide delivery instructions to a warehouse from which the product is sourced and delivered to the nominated outlet. Alternately the distribution means is configured to instruct the warehouse to deliver product to a regional depot from which top-up deliveries to the outlets can be effected. The distribution means may be configured to provide delivery instructions to one outlet of a

regional cluster of outlets and whereupon product from said one outlet which has surplus product is delivered to a product-depleted outlet of the cluster.

Preferably the system also comprises historical data analysis means which is configured to analyse historical data to assist in the forecasting of future product flow. More preferably the historical data used to forecast product flow includes but is not limited to product flow data from the same outlet, product flow data from other outlets and/or weather data. Even more preferably said analysis means provides a resolution sufficient to forecast product flow patterns within the product shelf life. Still more preferably the data analysis means can be applied during a product flow period to forecast product flow with the same product flow period.

Preferably the outlets are retail stores and the product is a sales product. More preferably the sales product has a relatively short shelf life, for example newspapers or perishable goods such as bread.

According to a further aspect of the invention there is provided a method of counting product, said method comprising the steps of:

weighing a supply of the product;

measuring changes in the weight of the supply as a result of depletion or addition of product from or to the supply;

identifying the product; and

calculating or deducing the change in the number of products removed from or added to the supply, said calculation or deduction based on the corresponding change in the weight of the supply.

Preferably the step of calculating the change in the number of products is performed at a counting processor and the method of counting further comprises the step of relaying the changes in the number of products from the counting processor to a remote server. More preferable the remove server includes a database having information pertaining to specific product types, including unitary product weights, and wherein the remote server transmits

this information to the counting processor to assist in the calculation or deduction of the change in the number of products.

Preferably the step of weighing the supply of the product is performed continuously. More preferably the weighing of the supply is conducted by scales communicating with the counting processor and wherein weight information from the scales is continuously or periodically transmitted to the counting processor.

Preferably the step of calculating the change in the number of products involves dividing the corresponding change in weight by the unitary weight of the product. More preferably the unitary weight of the product is empirically determined by monitoring changes in the supply weight from which a common divisor is calculated and which is assumed to be approximately equal to the unitary weight. Alternately the unitary weight is determined independent of the counting method.

Preferably the method of counting also comprises the step of identifying the type of product of the supply. More preferably said identification is effected by comparing the unitary weight of the product with a schedule of unitary weights for given product types. Even more preferably this identification step includes matching of the product unitary weight to that of the specified product type in the schedule. Still more preferably the product type schedule resides in the database at the remote server.

Preferably the step of measuring changes in the weight of the supply includes time logging of changes in the number of products wherein product turnover for a predetermined period can be calculated, for example the number of products removed in a 24 hour period. More preferably the frequency of change can alone, or together with the step of identifying the type of product by the unitary weight comparison, be used to identify the type of product of the supply wherein the product turnover frequency is compared and matched to a schedule of turnover frequencies for specified product types. Even more preferably the product turnover schedule is contained in the database at the remove server.

Preferably the method of counting also comprises the step of eliminating spurious measurements of noise from the measurement of changes in the weight of the supply. More preferably this is effected by averaging raw weight data from the continuous weighing of the supply.

According to yet another aspect of the invention there is provided a system for counting product, said system comprising:

means for weighing a supply of the product;

means for measuring changes in the weight of the supply as a result of removal or addition of product from or to the supply, said measuring means communicating with the weighing means;

means for identifying the product; and

means for calculating or deducing the change in the number of products removed from or added to the supply, said calculation or deduction based on the corresponding change in weight of the supply.

Preferably the means for weighing includes a scale.

Preferably the means for measuring changes in the weight of the supply and the means for calculating or deducing the change in the number of products are together included in a counting processor which communicates with the scale. More preferably the scale is one of a plurality of scales each being dedicated to a product type and together communicating with the counting processor.

Preferably the system also comprises a remote server communicating with the counting processor, the remote server being configured to receive data pertaining to changes in the number of products removed from or added to the supply. More preferably the remote server includes a database having information relevant to specific product types, including unitary product weights, and wherein the remote server transmits this information to the counting processor to assist in the calculation or deduction of the change in the number of products.

Preferably the system also comprises means for identifying the type of product of the supply.

Preferably the system further comprises means for supporting the product supply on the weighing means, the product being dispensable from said support means. More

preferably the support means is designed so that it insulates against external forces other than those associated with the removal or addition of product.

Preferably the weighing means and the counting processor are installed at a store and the product is a sales product which typically has a short shelf life, for example newspapers or perishable goods such as bread.

BRIEF DESCRIPTION OF THE FIGURES

In order to achieve a better understanding of the nature of the present invention a preferred embodiment of a method and system for managing product inventory levels together with a method and system for counting product will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a schematic representation of an embodiment of a method and system for managing product inventory levels according to the invention;

Figure 2 a schematic illustration of the method and system of figure 1 in more detail;

Figure 3 is a schematic representation of an embodiment of a method and system for counting product;

Figure 4A and 4B are schematic illustrations of the method and system of figure 3 in more detail;

Figure 5 is a graph of weight versus time for sample data from the system of figure 4A and 4B;

Figure 6 is a graph of weight and product count versus time for the system of figure 4A and 4B; and

Figures 7 and 8 are graphs of the number of products versus the time of day for a sample data output from the system of figure 4A and 4B.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As best shown in figures 1 and 2 there is a system for managing product inventory levels designated generally as 10.

As shown in figure 1 the inventory management system 10 broadly comprises means for monitoring the flow of product 12, means for capturing product flow data in real time 14, and means for controlling the delivery of product 16. The monitoring means 12 communicates remotely with the capturing means 14 which in turn communicates with the control means 16 to selectively deliver product.

The monitoring means 12 is located at an outlet or in this example retail store 18 which may be one of a plurality of stores 18 and 18' in a retail chain. As shown in figure 2 the monitoring means is in the form of a plurality of weighing scales such as 20A to 20C being configured to count product removed from or added to the scale such as 20A. The product in this example is a newspaper and a supply or stack of the newspapers such as 22A is dedicated to the corresponding scale 20A. The monitoring means 12 also includes a counting processor 24 which operatively communicates with the scales 20A to 20C via a wire or wireless connection such as 26A. The monitoring means 12 of this embodiment functions independent of data collection devices such as point-of-sale (POS) devices including bar code scanners which rely upon product identification tags such as RF tags.

The monitoring means 12 for each of the stores such as 18 communicates remotely with the data capturing means 14 via a communications network 28. In this example the communications network is in the form of the Internet to which the data processor 24 is connected via a modem 30. The capturing means 14 of this embodiment includes a remote server 32 which communicates with each of the outlets or stores such as 18 via the communications network 28. The server 32 includes a database 34 within which product flow data from each of the stores such as 18 is retained. This product flow data which in this example includes the number of newspapers departing each of the outlets or stores such as 18 is in real time transmitted to the remote server 32 via the Internet 28.

The inventory management system 10 of this example includes one or more portable devices such as the PDAs 36 of figure 2. The PDA 36 communicates across a wireless connection with the remote server 32 via a HTTP interface 38. The HTTP interface 38 communicates with a processing engine 40 of the remote server 32. The control means of this embodiment includes the processing engine 40, remote server 32 and PDA's 36 in combination. As best shown in figure 1 the control means also includes a product distribution means 16 which provides delivery instructions to a warehouse or factory 42 via

a communications link 44 such as telephone, fax, e-mail or data protocol. This delivery instruction will be dependent on the real time product flow data from each of the outlet or stores such as 18 and can include an instruction for:

1. the warehouse or factory 42 to make a bulk delivery designated as 44 directly to each of the outlets;

2. the warehouse or factory 42 to make localised deliveries designated as 46 to regional depots such as 48 which in turn can as instructed make top-up deliveries to the designated store such as 18; and

3. one outlet such as 18 of a regional cluster of outlets to deliver product to an outlet 18' of the cluster.

Otherwise, the general steps involved in operation of the inventory management system 10 include:

1. the monitoring means 12 monitoring the flow of product at each outlet so as in this example to count the sales of newspapers such as 22A from each store 18;

2. capturing this product flow or sales data in real time by transmitting the sales data to the remote server 32 via the communications network 28; and

3. depending on the product flow or sales of newspapers 22A from each outlet or store such as 18, controlling the delivery of newspapers to the outlet so as to control its inventory.

This embodiment of the method and system for inventory management allows each of the outlets or stores to optimise their inventory levels. For example, the system ensures that the outlets supply of newspapers are sold within their shelf life (usually by the end of the day) or sales opportunities are not missed where newspaper supplies are prematurely depleted (within their shelf life). In capturing the product flow data in real time there is reduced time between for example sale of the newspapers and recordal of this data at the remote server for controlling delivery schedules. The remote server thus supports and/or performs the analysis of product flow data to optimise inventory levels, sales, returns,

distribution costs, distribution logistics and other factors. The product flow data may be used to forecast:

1. future product sales at each outlet and possibly adjust this forecast depending on product flow data from other outlets;

2. product flow based on historical, present or forecast weather information in the vicinity of the outlet or store;

3. product flow data for stores not connected to the server (or for which data has not been collected) this forecast being based on historical data for stores in similar locations and possibly having similar demographics.

This forecasting of data allows the inventory management system to be adjusted from a delivery schedule determined by the real time product flow data which is captured. The system also provides a mechanism to optimise delivery routes for which the following factors need to be considered:

1. location of the outlet or store and typical traffic conditions surrounding the outlet and routings to and from the outlet;

2. travel or delivery times for each of the delivery mechanisms, for example bulk delivery trucks or low volume delivery bikes, between outlets;

3. current inventory levels at each store and estimated times in which product will be exhausted; and

4. data relating to the delivery mechanisms such as their number and type and operational costs.

In the preferred example the distribution means 16, based on a combination of real time and historical data, instructs the warehouse 42 to deliver a bulk supply of product to each of the stores such as 18 and 18'. This bulk supply is determined such that there is a high level of confidence that the product will sell out within its shelf life period. The distribution means 16 also instructs the warehouse 42 to deliver products to a regional depot such as 48. The real time monitoring and capturing of product flow (or newspaper sales data) then allows the distribution means 16 to provide additional instructions for supplementary

deliveries to the nominated outlet such as 18. These supplementary deliveries may be made from either the warehouse 42 or the regional depot 48. This prevents products from selling out prior to the manufacture and supply of fresh replacement products.

In regions containing outlets or stores such as 18 and 18' in close proximity to each other, the bulk delivery from the warehouse 42 can be larger wherein there is a reduced confidence in each of the stores such as 18 selling their allocated product. However, there is a high degree of confidence that the regional store cluster can sell their combined products by "rebalancing" deliveries. These deliveries are based on the real time product flow or sales data captured by the server 32. The PDA's such as 36 also allow delivery data to be remotely transmitted to the server 32 via a wireless link.

The HTTP interface 38 provides user access to the data information residing within the server 32. A plurality of users such as 50 can concurrently utilise the functionality of the server 32 using the HTTP interface 38. The functions available to a user such as 50 can be limited based on intersection of the users roles and the authorised roles of each of the functions.

Figures 3, 4A and 4B illustrate an embodiment of a system for counting product designated generally as 52. Although this aspect of the invention can be utilised in the method and system for product inventory management of figures 1 and 2, it may also be used independently or in other applications.

The system for counting product 52 is in the preferred example used for counting a supply or stack of newspapers 54. The system 52 broadly comprises weighing means 56, means for measuring changes in weight 58, and means for calculating or deducing the change in the number of products 60. The weighing means 56 communicates with the measuring means 58 via a wireless connection 62.

As shown in figure 4A and 4B the weighing means 56 is in the form of scales which includes a load cell 64 mounted between a pair of vertically spaced rigid plates 66A/B. The scales also include a collocated measurement interpretation device 68 electronically connected to the load cell 64 and which converts load cell signals into weight measurements. The measurement device 68 can be calibrated to ensure that weight measurements are

accurate, and as shown in figure 4B it includes a display 69 for operational information such as newspaper identities, newspaper weights and newspaper stack weights.

The display 69 may be in the form of an LED strip on which messages or advertising are screened. These messages or advertising may be general or specific to for example content in the newspaper. The display 69 may include extracts from the classified section of a newspaper, such as "3 BRM House for $800K in your area" or "BMW 318i in your area", or of general interest such as "Rugby League scandal!" or "David Jones Mothers Day Special". The display 69 would in these and other examples be configurable remotely and in real-time and localised to the outlet in which the scales re located. The display 69 may be configured remotely by the vendor (in the case of newspapers, e.g. Fairfax), the store or outlet owner (by for example SMS), or a system administrator at the remote server.

The counting processor 58/60 is in this example connected to the measurement device 68 via a wired or wireless connection utilising a RS-485, RS-232 or RS-449 standard communications protocol. The counting processor 58/60 communicates remotely with a server (not shown). This remote communication is provided across a communications network 70 such as the Internet to which the counting processor 58/60 is connected via a modem 72. The remote server is configured to receive data such as additions or removals of newspapers from the weighing means 56. The remote server may also include a database having information relevant to specific product types, such as unitary newspaper weights for a given day and the newspaper stack weight. The remote server is configured to transmit this product specific information to assist in the calculation or deduction of the change in the number of products which is derived from the change in weight.

The general steps involved in the counting of a product, in this example newspapers, utilising this system are as follows:

1. a supply of the product such as the stack of newspapers 54 is weighed on the weighing means 56;

2. changes in the weight of the supply are measured at the counting controller 58/60 as a result of removal or addition of newspapers to the stack; and

3. the number of newspapers removed from or added to the stack 54 are calculated or deduced at the counting controller 58/60 based on the corresponding change in the weight of the stack 54.

The step of weighing the supply of the product is performed continuously and the weighing means 56 communicates with the counting processor 58/60 for continuous or periodic transmission of weight data. The step of measuring changes in the weight of the supply may also include time logging of changes in the number of products and in the preferred example this information is retained in the database of the remote server. The logging of changes in the number of products may be used in a determination of product turnover, for example in the number of products removed in a 24 hour period.

Importantly, the number of products removed from or added to the supply is calculated or deduced from the change in the supply weight. The various techniques used in calculating or deducing this count include:

1. the change in weight of the supply is divided by the unitary weight of the product which is "input" independent of the counting method; and

2. the unitary weight of the product is empirically determined by monitoring changes in the supply weight from which a common divisor is calculated and which is assumed to be approximately equal to the unitary weight, and the change in supply weight is divided by this divisor/unitary weight.

The method of counting may also involve identification of the type of product. This identification step will generally be performed utilising a product type schedule which resides in a database at the remote server and includes products of specific information including product unitary weights and product turnover frequency. The product identification step may then involve:

1. comparing and matching changes in unitary weights with the schedule of unitary weights at the remote server so as to imply a product type; and/or

2. comparing and matching real time product turnover with a schedule of turnover frequencies for specified product types so as to deduce the product type.

Figures 5 to 8 illustrate in graphical form the changes in weight and product count for in this example the sale of newspapers at a newsagency. In figure 5 the squiggly line shows raw strain gauge input data to the measurement device 68 whereas the straight lines present output weight data to the controller 58/60. Figure 6 illustrates a developed version of this product removal or addition data with product counts alongside step changes in the graph.

Figures 7 and 8 show an output from the counting processor 58/60 which is time logged for a 6 hour period. This product count output from the counting processor 58/60 can be captured in real time at the remote server. This graph shows an original stocking of newspapers at 6.15am and the subsequent replenishment of newspapers on three occasions. Figure 7 shows the bundle and unitary weights for the newspapers. It will be appreciated that the weighing means 56 of figures 3 and 4 are one of a plurality of weighing means located at for example the same newsagency and together linked so as to communicate with the counting processor 58/60.

Now that a preferred embodiment of the present invention has been described in some detail it will be apparent to those skilled in the art that the method and system for managing product inventory levels together with the method and system for counting product have at least the following advantages:

1. product inventory levels are optimised where minimal product is held by an outlet outside its shelf life whilst sufficient stock levels are maintained to avoid loss of sales opportunities from no stock;

2. the product inventory management system and method is non-invasive and functions independent of data collection devices which may for example require bar codes or rf tags on the product;

3. the method and system for counting product are relatively inexpensive yet effective in their utilisation of weight scales to measure changes in the weight of the product supply.

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. For example, the product to which the system and method are applied is not limited to

newspapers or other products having a short shelf life but rather extends to practically any product for which inventories are to be monitored. The specific architecture of the inventory management system may vary provided it falls within the scope of the broad aspect of the invention. Similarly, the design and architecture of the system and method for counting may vary provided counting of product is effected by measuring changes in the weight of a product supply.

All such variations and modifications are to be considered within the scope of the present invention in the nature in which is to be determined from the foregoing description.